Case Study 3

G*roup 2*

# Identify Cognitive and Social Biases

## Cognitive Biases:

### Confirmation Bias – Ignoring Early Warning Signs

* *Definition:* The tendency to favor information that confirms pre-existing beliefs while disregarding contradictory evidence.
* *Evidence in the Case:*
* The crew did not react immediately to a continuous uncontrolled oxygen leak lasting 3 minutes and 23 seconds.
* They relied on past assumptions that minor oxygen leaks did not pose a major threat.
* A conversation between the pilots about diverting to Athens or Albania included a remark potentially referring to one pilot's smoking habits: "Have you stopped smoking [or what/not], I can't smell [the smoke/smell]?"

### Anchoring Bias

* *Definition:* A tendency to rely too heavily on the first piece of information encountered when making decisions.
* *Evidence in the Case:*
* Early safety assessments during maintenance led the team to anchor on the assumption that the oxygen system was secure, even as new data suggested potential hazards; the initial judgment was never fully reconsidered.

### Overconfidence Bias

* *Definition:* Excessive belief in one's abilities or prior success, leading to an underestimation of risks and potential errors.
* *Evidence in the Case:*
* The maintenance crew's history of incident-free operations may have bred overconfidence, causing them to dismiss anomalous signals and underestimate the probability of an oxygen fire.

### Availability Heuristic

* *Definition:* Basing decisions on information that is most readily recalled, often influenced by recent or vivid examples rather than a comprehensive analysis of all risks.
* *Evidence in the Case:*
* Past maintenance operations that went smoothly were more easily recalled by decision-makers, leading them to downplay the significance of less common, yet critical, warning signs of an impending oxygen fire.

### Hindsight Bias

* *Definition:* The inclination to believe, after an event has occurred, that the outcome was predictable all along.
* *Evidence in the Case:*
* During post-incident analysis, investigators implied that the signs of an oxygen fire were obvious in retrospect, which may oversimplify the actual complexity and real-time uncertainties faced by the team.

### Sunk Cost Fallacy

* *Definition:* The tendency to continue an endeavor based on the cumulative prior investment of time, money, or effort, even when new evidence suggests it may be unwise to proceed.
* *Evidence in the Case:*
* Despite emerging safety concerns during the maintenance process, teams continued operations partly because significant resources had already been committed to the task, leading to a reluctance to change course.

## Social Biases:

### Authority Bias – Overreliance on Standard Procedures

* *Definition:* The tendency to defer to authority figures or established protocols without question.
* *Evidence in the Case:*
* The crew strictly followed standard oxygen system procedures, even though those procedures were not designed for an oxygen-fed fire.
* The BEA study found that cockpit fire-fighting protocols were ineffective against oxygen-fed fires, but the crew still attempted to use a halon extinguisher, which was not suitable.
* Elements relating to smoking in the cockpit: A conversation between the pilots about diverting included a remark potentially referring to one pilot's smoking habits: "Have you stopped smoking [or what/not], I can't smell [the smoke/smell]?"

### Groupthink – Avoiding Disrupting the Team Consensus

* *Definition:* When individuals prioritize agreement over critical thinking, leading to poor decision-making.
* *Evidence in the Case:*
* The crew did not challenge each other's assumptions or question whether the oxygen fire required a different approach.
* The failure to act on early smoke warnings indicates that there was no strong push from any crew member to reassess the situation critically.

### Normalization of Deviance – Accepting Risky Shortcuts

* *Definition:* When unsafe practices become routine over time because previous incidents didn't lead to disaster.
* *Evidence in the Case:*
* The oxygen system had a history of minor leaks, but these were treated as non-urgent, leading to complacency over time.
* Previous oxygen-related incidents in other aircraft were not seen as a serious safety threat, reinforcing the idea that such leaks were manageable.

# Decision-Making Analysis

## Decision Point 1: Initial Response to the Oxygen Leak and Fire

### Bias Identified: Normalcy Bias

Normalcy bias occurs when individuals underestimate the likelihood or severity of an emergency due to the event having never took place in familiar conditions. In this scenario, the flight crew may have initially underestimated the danger posed by an oxygen leak in the cockpit. The presence of oxygen significantly accelerates fire propagation; therefore, any delay in response allowed the fire to spread rapidly.

### Impact on Outcome

The fire in the cockpit escalated uncontrollably, causing damage to critical flight systems. A delayed reaction may have contributed to the failure to contain the fire before it compromised essential aircraft functions.

### Mitigation Strategy

An evidence-based approach, such as enhanced scenario-based training, could have assisted the crew in recognizing the severity of oxygen-fed fires more effectively. Implementing automated fire detection alerts specific to oxygen-related incidents and reinforcing immediate action protocols in standard operating procedures would have improved the response time.

## Decision Point 2: Use of Fire Extinguishers in an Oxygen-Fed Fire

### Bias Identified: Availability Heuristic

The availability heuristic is a cognitive bias where individuals rely on immediate, familiar solutions rather than evaluating alternative responses. The crew attempted to fight the fire with a halon fire extinguisher, which is effective for electrical and standard fuel-based fires but ineffective for oxygen-fed fires.

### Impact on Outcome

The attempt to extinguish the fire with halon was unsuccessful, allowing the fire to spread further. This misstep contributed to electrical failures and the subsequent loss of control of the aircraft.

### Mitigation Strategy

A procedural shift emphasizing evidence-based decision-making in emergencies could have improved the crew’s response. Cockpit fire procedures should incorporate specific training on recognizing oxygen-fed fires, characterized by a "blowtorch-like" sound, and prioritize shutting off the oxygen supply as the primary response rather than attempting to extinguish the flames. Updating safety training and ensuring the availability of alternative fire suppression methods, such as oxygen-compatible extinguishers, would also enhance fire response effectiveness.

# Recommendations for Mitigation

## Recommendation 1: Implement Structured Decision-Making Frameworks

### What It Involves:

Adopt formal decision-support tools such as detailed checklists, risk assessment protocols, and red-team reviews. These tools encourage teams to systematically evaluate new evidence rather than relying solely on initial assessments.

### Benefits:

Mitigates anchoring and overconfidence biases by ensuring that decisions are reviewed in a structured manner, incorporating diverse perspectives and updated data.

## Recommendation 2: Utilize Real-Time Analytics and Monitoring

### What It Involves:

Integrate sensor technologies and real-time data analytics to continuously monitor critical parameters (e.g., oxygen levels, system pressures, and temperature fluctuations).

### Benefits:

Provides objective, up-to-date information that can alert teams to emerging risks, countering the influence of availability heuristic by highlighting less obvious but significant anomalies.

## Recommendation 3: Enhance Training and Post-Event Debriefing

### What It Involves:

Regularly train staff on recognizing cognitive biases and the importance of adaptive decision-making. Use simulation-based training to practice emergency responses and conduct thorough debriefs after maintenance activities to review decision processes.

### Benefits:

Helps combat hindsight bias and sunk cost fallacy by fostering a culture of continuous learning and objective review, ensuring that future decisions are informed by both past successes and areas for improvement.